

successors, Maurice Pézard and Count R. de Mecquenem, have also published during the last fifteen years memoirs of importance dealing respectively with the earliest historical remains at Bushire, and with subsequent developments at Susa, while M. Paul Toscanne of the Louvre has edited a series of valuable monographs on special points arising from the investigations of his French confrères. Dr. Herzfeld, a German archaeologist, has, quite recently (1924) re-examined Persepolis, and has brought to light here, and at a newly discovered site in the Mamasani country, sixty miles west south-west of Shiraz, several important inscriptions; he has submitted to expert examination, for the first time, the early burial caves and rock carvings on Kharag Island which he has demonstrated to have been occupied by a Christian community as early as the third century A.D. Dr. J. Theodore Bent visited Bahrain in 1889 and commenced excavations in the hope of elucidating the riddle of the vast assemblage of burial mounds there, which he ascribed to the Phoenicians: these had already been reported on by Capt. Durand in 1880: some further excavations were undertaken in 1906-7, at the instance of the Government of India, by Major (now Lt.-Col.) Prideaux, the Political Agent, but with inconclusive results.* Further investigations were made in 1924 by Mr. E. MacKay, no report of which has yet been published.

Dr. Hogarth's book on Arabia summarizes in convenient form what little is known of the archaeology and anthropology of Arabia, and Professor Myres, in the opening chapter of the *Cambridge Ancient History*, has made the most of the very scanty material available, and restated the position in this respect,¹ so far as known to us, in a series of brilliant generalisations. But, if we except Bushire, Susa and Persepolis, scarcely a beginning has yet been made in this surely most remunerative field. Oman is still untouched by the spade, though extensive ruins with numerous inscriptions are said to exist only five miles west of Sohar: the ancient towns of Sur, Dhufar and Kalhat, to mention only three, have never been examined by an archæologist; Gerrha, Qais, Siraf, and many other ports have yet their secrets to yield, and I do not doubt that whoever ultimately has the privilege of undertaking this task will reap a rich harvest.

BOTANY:²

Our earliest authorities are Pythagoras, Demochitus,³ Theophrastus and Dioscorides but, excluding these and the incidental references to botanical subjects containing in early printed books, the first serious attempt to collect and classify botanical specimens from the Gulf region was made by Aucher Eloy and published in his *Relation de Voyages en Orient de 1830 à 1838* (Paris 1840). In the same year Antonio Bertoloni published an account of the plants obtained by the Chesney Expedition, in *Miscellanea Botanica*, ii, *Novi Comment. Acad. Sci. Instit. Bonon.*

Major H. A. Sawyer was at pains to make as complete a collection of plants and shrubs as possible during his journeys in the Bakhtiari country in 1889-91, and the notes of the Curator of the Royal Botanical Society on the collection are printed as an Appendix to his report,⁴ which is available for students in India Office Library: a few years previously O. Stapf had published, in 1886, in the *Botanisches Centralblatt*, 1886, xxvii, pp. 211, 243, 275, a paper on "*Vegetationsbilder aus dem Sudlichen und Mittleren Persien.*"

Some valuable botanical notes were made in 1893 by Leo Hirsch ("*Reisen in Sud Arabien, Mahraland und Hadramaut.*" Leiden, Brill. 1897), and, subsequently, relating to the same area, by Dr. J. Theodore Bent, "Exploration of the Frankincense Country, S. Arabia," *Geog. Jour.*, 1895, vi, p. 133. See also J. G. Baker, "Botany of the Hadramaut Expedition," *Kew Bulletin*, 1894, p. 328, and 1895, p. 315.

Major (now Lt.-Col.) S. G. Knox, Political Agent at Kuwait, made a

*The Sepulchral Tumuli of Bahrain—See *Archæological Report of India*, 1908-9.

¹ Omitting, however, any reference to tumuli at Bahrain.

² With acknowledgments to Mr. R. D'O Good, Brit. Mus. Nat. Hist.

³ Pliny, Lib. xxv, Chap. vi.

⁴ Report of a Reconnaissance in the Bakhtiari country, South-West Persia, Simla, 1891.

careful collection of desert shrubs found in the Zor hills in the hinterland of Kuwait. These were examined by H. G. Carter of the Botanical Survey of India, whose report on each specimen, with the Arabic name attached, was published by the Government of India, *Records Botanical Survey of India*, vi, p. 175, 1912. In the same series (Vol. viii, No. 1, 1919) is published "*Flora Arabica*," by that well-known authority Father E. Blatter. The student should also see Mrs. Bishop's *Journeys in Persia and Kurdistan*, vol. i, p. 290 *et seq.*, and preface, p. viii, 1891. Some further information on this subject is contained in Philby's *Heart of Arabia*, 1922, ii, p. 309, and in an appendix to Floyer's *Unexplored Baluchistan*, 1882; and much of Ainsworth's Botany of the Afghan Boundary Commission, 1887 (from *Trans. Linnæan Soc.*, Series ii, vol. iii) applies to Persia.

Mesopotamian flora were specially dealt with by Emilio Chiovenda, "Contributo alla Flora Mesopotamia-Malpighia," xiv, 1900, and Buxton's *Animal Life in Deserts*, 1924, contains some useful information on the distribution and habits of desert plants.

These reports and contributions represent the sum total of our knowledge of the systematic botany of this region, and a fruitful field of research awaits any resident who has the energy to take up this inexpensive and interesting hobby.

ETHNOLOGY :

Duhoussat (*Etudes sur les populations de la Perse et pays limitrophes pendant trois années de séjour en Asie*, 1863) and Nicolas de Khanikoff (*Memoire sur l'Ethnographie de la Perse*, Paris, 1866) are our first and, perhaps, our best authorities, followed by De Morgan and Tomaschek. See also *The Cambridge Ancient History*, vol. i.

GEOGRAPHICAL SURVEYS :

The geographical surveys, executed by the Chesney Expedition and by officers of the Indian Navy in Mesopotamia and Arabistan in the first half of the nineteenth century, combined with the marine surveys between 1820-8 of Brucks and Haines, Constable and Stiffe, and other officers of the Indian Navy along the littoral, which were checked wherever facilities existed for ascertaining longitude by telegraph, formed a useful framework on to which subsequent work was grafted and embodied in successive editions of the standard maps produced by the Survey of India; much original work, however, was lost by the carelessness and indifference alike of the Government of India and of His Majesty's Government. The valuable work of the Turco-Persian Commission, in 1850 and the succeeding years, never seems to have been incorporated in published maps, no copies having been transmitted to the Government of India by His Majesty's Government; and no serious attempt seems to have been made until after the Persian War in 1856 by the military or survey authorities in India to collate the observations of numerous travellers or to encourage the preparation of reconnaissance reports or the correction of existing maps.

The *Geographical Memoir* of Capt. Macdonald, afterwards Sir J. Macdonald Kinneir, British Minister in Persia, published in 1813, and supplemented later by a further publication,¹ for some time enshrined the corpus of available geographical knowledge of the country; to which important additions were made by several English or Indian officers, notably Grant, Pottinger, Christie and Monteith who, like Kinneir, came to Persia with Sir John Malcolm. In 1840, De Bode filled in some empty spaces in existing maps, though he made no attempt at systematic exploration. After him came Major (afterwards Sir Henry) Rawlinson, whose topographical researches, when employed as an officer in the service of Muhammad Shah, were of outstanding merit and covered very extensive areas in South-West Persia.² Sir H. Layard, a not inferior name, also most fortunately devoted to South-West Persia, including

¹ *Journey through Asia Minor, Armenia and Koordistan*, 1818.

² Notably by his "Notes on a March from Zohab . . . to Khuzistan (Susiana)," and thence through the Province of Luristan to Kirmanshah, in the year 1836. (*J.R.G.S.*, 1836, January.)

Arabistan, Pusht-i-Kuh and the Lower Bakhtiari country, those gifts of insight and of style that have rendered him famous.

The surveys undertaken by Sir F. Goldsmid in Persia and in connection with the settlement of the Perso-Baluch frontier between 1870-2 also resulted in a very considerable addition¹ to our knowledge of Persian conditions and of the geography of South-East Persia and the Persian Gulf. The construction of a telegraph line from Bushire *via* Tehran to Khanikin by the British Government in agreement with the Persian Government resulted in a number of detailed surveys between 1860 and 1862, by officials² of the Telegraph Administration under the orders of Lt.-Col. Patrick Stewart and Major Bateman Champaign.³ In 1863 a telegraph line was constructed from Karachi to Gwadur through States of Kalat and Las Bela to Gwadur and subsequently to Jask. The surveys for these lines, and the telegraphic determination of longitudes at various points covered South and Central Persia with a network of route surveys punctuated by accurately determined points, and resulted in the publication in 1873-4 of Capt. O.B.C. St. John's Map of Persia, 16 m.=1 inch, in six sheets "compiled principally from original authorities, by order of His Majesty's Secretary of State for India".

This was one of the most valuable maps of Persia ever made. Sir O.B.C. St. John joined Lt.-Col. P. Stewart's expedition to Persia in 1863, for the purpose of establishing telegraphic communication from India to the Bosphorus. His own duties lay in the Persian section, and he was in charge of the last telegraphic division, which was, at the same time, the most important and the most difficult. Later, he superintended the construction of the line from Tehran to Bushire. In 1871 he went to Baluchistan as Boundary Commissioner of the Perso-Kalat frontier, and completed the survey of that boundary. On his return to England he was employed on special duty at the India Office, during 1873 and 1874, in compiling this great map of Persia and Persian Baluchistan. The map was based on longitudes of the principal Persian telegraph stations, fixed in co-operation with General Walker of the Indian trigonometrical survey, Capt. W. H. Pierson, R.E., and Lieut. Stiffe of the Indian Navy, by whom time-signals were exchanged between Greenwich and Karachi on the one hand, and stations in Persia on the other.

Twenty years later, officials in the Persian Gulf were encouraged by Lord Curzon to undertake a series of investigations along the Persian Gulf littoral. The late Mr. J. G. Lorimer made extended investigations along the Arabian littoral: Capt. (now Sir P. Z.) Cox who, in 1901 and 1902, had made important additions to our knowledge of Oman,⁴ examined the Persian littoral from Dilam to Qubban in 1905 and, in Oman, travelled by land from Ras al Khaima to Sohar *via* Baraimi, a route which had been traversed in the opposite direction and sketched by Capt. Hamerton, in 1840.⁵ In the same year, Capt. (now Lt.-Col.) S. G. Knox, visited Hafar, a famous landmark in the interior, distant 160 miles from Kuwait, which, though mentioned by previous European travellers in Arabia, had not been reached by any of them. In this field he was brilliantly followed by the late Capt. W. H. I. Shakespear and the late Lt.-Col. Leachman, and the late Miss Gertrude Bell. Lt.-Col. Burton and Capt. (now Lt.-Col.) Lorimer made a number of most productive journeys in Arabistan which were extended in subsequent years to Pusht-i-Kuh by the former, and to the same region, Luristan and the Bakhtiari country by the latter.

¹See *Telegraph and Travel*, Goldsmid, 1874, a well written and well illustrated book which deserves to be much better known.

²An outstanding example is E. A. Floyer of the Indo-European Telegraph Department whose book *Unexplored Baluchistan* (1882) is still a useful work of reference though he travelled in 1876-7.

³The late Sir Henry Mance, who died at Oxford in April 1926, was the inventor of the heliograph: as a young man he was employed by the I.E.T.D. in the Persian Gulf, where the soldiers of Alexander the Great are said to have signalled by flashing the sun from their shields. It was in developing this idea that he invented the heliograph.

⁴See *Overland Journey from Maskat to the Persian Gulf*, G. J. 1902, xx, and *Some Excursions in Oman*, G. J., 1925, Sept.

⁵See marginal note to "Map of Maritime Arabia." Bombay Selections, xxiv, 1856.

The latter tract, which, with the possible exception of the Aoraman Range of Central Kurdistan, is the most lofty and inaccessible part of the great Zagoros chain, had been very thoroughly explored in 1889 by Major H. A. Sawyer of the Bengal Staff Corps, assisted by Indian surveyors: his maps and reports, though amplified in places by subsequent explorers, notably by McSwiney (1891) in the south, Capt. Lorimer (1903-8), Capt. Ranking (1909-11), and Capt. Noel (1915-17), are and will long remain classic authorities.

The explorations of Major (now Sir P.) Sykes are too well known to require detailed reference here: they were supplemented, under his instructions, during the war, by several valuable detailed surveys, especially in Fars.

Nor must we omit to mention the valuable and varied information on geographical and scientific topics collected by De Morgan and published in 1895 in his *Mission Scientifique en Perse*. In this work, attention was for the first time prominently drawn to the *bande pétrolifère* stretching south-east from Kirkuk, in which De Morgan considered might be found the most important source of wealth throughout the whole region; and the possibility of a pipe line from Khanikin to the Mediterranean was for the first time mooted and discussed, as also the proposal for a Baghdad-Tehran railway. Had De Morgan followed up his views on this matter in South-West Persia, the history of the oil industry might have been different!

The fruits of the labours of these and of many other travellers, official and unofficial, were embodied by the Survey of India in a succession of standard sheets, first on the 8 m.=1 inch scale (and later in $\frac{1}{2}$ inch sheets, a complete series of which, covering the whole of Persia now exists, and is constantly, though all too slowly, under revision. For general purposes, the Survey of India have published at intervals since 1875 successive editions of St. John's map referred to above on the 16 m.=1 inch scale, which has now been replaced by the corresponding sheets of the International Series on the scale of 1 million and by sheets on the $\frac{1}{2}$ million scale. The 1 million sheets covering the northern part of the Arabian peninsula embody, in addition, the vast mass of material gleaned previous to 1910 from native information,¹ to which most important accessions have since been made by the late Lt.-Col. G. E. Leachman, the late Capt. W. H. I. Shakespear, Mr. H. St. J. Philby, Major R. E. Cheesman and others and, since the Armistice, between Baghdad and Jerusalem and Damascus, by the devoted labours of Major A. E. Holt.

It may fairly be said that in the matter of maps, no part of the world, not forming part of the British Empire, has been better served by British topographers, but the gaps in our knowledge of local geography are still many, and serious. Oman is still to a great extent unknown; the immediate hinterland of the Trucial Oman has never been explored; Musandam has not yet yielded all its secrets; we still await a survey of the Hasa littoral. On the Persian side of the Gulf, not only are there still some blank spaces to be filled, notably in the Kuhgilu Hills and the Mamasani and Boir Ahmadi country, but the utility of existing maps is diminished in practice by the conditions under which they have been compiled, and from the absence of a proper system of triangulation, so that, in many cases, they cannot be relied on off the main routes. Had the money, which has been devoted from time to time to particular surveys, and to the extended journeys of individual consular and military officials, been spent on a well thought out survey programme covering a period of, say, twenty years, we should have, by this time, a complete and accurate survey of both sides of the Gulf on the $\frac{1}{2}$ inch scale, in the light of which much that has been written on the subjects of roads and railways in Persia would have to be reconstructed. The writer states this conclusion with the less hesitation because, though his own travels have never extended to the Arabian Peninsula or to Persia east of a line drawn through Bandar Abbas, Shiraz, Isfahan and Tehran, it has been his good fortune to travel very extensively, both as a private person and on Government and commercial affairs, in West and South-West Persia, and in Iraq, between 1907 and the present day. He has himself surveyed, in South-West Persia, some hundreds of square miles with a plane table, and has had the opportunity of checking, on the spot, the work of Indian surveyors, amongst them those distinguished members of the Indian Survey Department, Khan Bahadur Yusuf Sharif and his friend Khan Bahadur Shir Jang, c. i. e., an Afghan by origin, who, in 1905, surveyed the vicinity

¹ Including the work of Huber, Wallin, Palgrave, Doughty, etc.

of Muscat, the Bahrain Islands, and the country surrounding the Bay of Kuwait. The writer has traversed, on foot or on mule or horse-back, almost every main road in South-West Persia and, in the course of many years, has visited almost every place of importance in Arabistan, Luristan, Pusht-i-Kuh, Bakhtiaristan and Fars. As Deputy British Commissioner and, subsequently, British Commissioner for the delineation of the Turco-Persian Frontier he visited every town and settlement on both sides of the boundary from Fao to Ararat, and climbed almost every pass across the Zagros Range, between the two countries.

In various capacities, during and after the Great War, it fell to him to visit every town in Iraq, by road and by air, and to discuss with successive Directors of Surveys, more particularly Lt.-Col. C. H. D. Ryder, afterwards Surveyor-General of India, and Lt.-Col. Pirrie of the same service, ways and means for a complete topographical and cadastral survey from Basra to Mosul. These discussions demonstrated how much time and labour and consequently money can be, and generally is, wasted on independent regional surveys, unless the preliminary work of triangulation has been carefully done, and unless a carefully thought out plan has been previously made and then adhered to.

The immense amount of fruitless discussion, time and money that has been lavished at various times in connection with the Perso-Baluch and Turco-Persian frontiers would also have been saved, and the British, Russian, and neutral zones of 1907 would, in the light of fuller geographical knowledge, perhaps have been more intelligently drawn, to the advantage of international peace and friendly relations.

MARINE AND RIVER SURVEYS

Charts of a kind for the guidance of vessels in the Gulf already existed in 1785 and these, Lieut. John McCluer, a self-taught surveyor of the East India Company's Marine, had devoted himself assiduously to correcting during a period of three years' service in the Gulf, the result of his voluntary labours being a chart of the whole north-eastern side of that sea and of the Shatt-al-Arab up to Basra, accompanied by a memoir, besides plans of the harbour of Muscat, Basra, and other ports.¹

The south-western or Arabian shores of the Gulf, however, remained for the most part practically unknown; and in 1810, when giving the commanders of the British Expedition against the Qawasim detailed instructions for the visitation of piratical ports, the only map which the Government of India could supply was a "topographical sketch" by one Saiyid Taqi, showing roughly the positions of eight or nine piratical places to the south-west of Ras al Khaima.

In 1811 a surveying officer was placed on board the East India Company's cruiser *Benares* in the Persian Gulf, but the nature of the duties on which the vessel was employed made systematic operations by him impossible. Towards the end of 1815 orders for a regular survey were issued by the Court of Directors of the East India Company, but danger from pirates made their execution impracticable.

¹ McCluer in the course of his progress made drawings of various parts of the coast to facilitate the navigation and wrote useful directions for the same purpose. These were used by the hydrographer of the East India Company, Mr. Alexander Dalrymple, who died in 1808. A chart of the Persian Gulf was compiled by the Admiralty in 1820, from the surveys of McCluer and other officers of the Bombay Marine.

A writer, reviewing, in 1829, the hydrographical work of McCluer, says: "When the works of an individual are carefully preserved and consulted as a standard authority by those who survive him, it is a sufficient proof of their excellence, . . . Those of Lieut. McCluer have stood the test of nearly forty years; the considerable addition they formed to the stock of hydrographical information, justly entitled their author to the acknowledgements of the maritime world; and at this distance of time we readily bestow our tribute to the memory of a man who has perpetuated his name by his valuable works. His first essay in the Persian Gulf, which alone proceeded from a desire of benefiting navigation, was a fair promise of the zeal which he afterwards displayed in the survey of the coast of Hindostan."

In 1817, a memoir on the ports and pearl banks of Bahrain, together with surveys, was prepared by Lieut. Tanner of the Bombay Marine; but it was not until 1820, on the conclusion of the third expedition against the Qawasim, that a proper survey of the south and west waters of the Gulf, beginning at Ras Musandam, was undertaken by Capt. P. Maughan in the *Discovery*, assisted by Lieut. J. M. Guy in the *Psyche*. Lieut. Guy succeeded to the direction of this survey in November, 1821, and he had carried his operations as far as the promontory of Qatar when, in February, 1823, his place was taken by Lieut. G. B. Brucks. Lieut. Brucks completed the survey of the Arabian Coast, which occupied him until 1825; and early in 1826 he began work on the Persian coast and islands, to which the following ten years were devoted. In 1828 operations were begun in the Gulf of Oman under his command, and were continued by Lieut. S. B. Haines, who finished the Makran coast to Karachi in 1829: the Oman side had previously been completed down to Muscat. The first marine survey of the Persian Gulf, partly from the smallness of the vessels employed, was a most arduous and painful service; and a lamentably large proportion of the officers employed on it either died or broke down in health from the effects of climate and hardship.¹

In 1835, an expedition under Col. F. R. Chesney left England for Turkish Arabia to make an experiment—for which the permission of the Porte had been obtained, and for which the British Parliament had granted £20,000, and the East India Company £5,000—in the direction of introducing steam navigation upon the Euphrates. Two river steamers were launched upon the Upper Euphrates in the course of 1835-6; but one of them, the *Tigris* was unfortunately lost in a storm within a few weeks after her completion: the remaining vessel, the *Euphrates*, navigated on the rivers Euphrates, Shatt-al-Arab, and Tigris, of which surveys were made, during the rest of the year; but in December the expedition was broken up, and the *Euphrates* was transferred on a valuation from the British Government to the East India Company. The experiment, in so far as it related to the establishment of rapid and certain communication between England and India cannot be described as a success; but Col. Chesney's surveys of the Euphrates, Tigris and Karun mark an important step in geographical progress: his chart of the Shatt-al-Arab, from Basra to the bar inclusive, is of particular interest, as showing the changes that have taken place during the last hundred years in this region.

The land and river surveys initiated by the Chesney Expedition were continued with great energy during more than twenty years by the officers of the Indian Navy employed with the British Mesopotamia flotilla, or the stationnaire of the Baghdad Political Agency; they extended to Arabistan and elsewhere, and to the confines of Persia with Iraq.

Commander Lynch (1837-43) surveyed the Tigris from Mosul to Ctesiphon, the Euphrates below Masharrah, and connected Niniveh, Baghdad, Ctesiphon and Babylon by triangulation. Lieut. Campbell (1841-2) surveyed the Tigris below Baghdad; Commander Felix Jones (1843-54) surveyed Zohab, the old Nahrwan Canal, the old course of the Tigris above Baghdad, and the Persian hills from Baghdad to Mosul. He also made a survey of the country from Musaiyib to Najaf the material of which was lost in the India Office, as also was that of a survey by Commander Selby (1841-2 and 1856-61) from Babylon to Samawa; a valuable chart of the Shatt al Arab from Basra to the sea, by Commander Felix Jones and Lieut. Collingwood, met with a similar fate. Selby also surveyed the Karua River with its branches and affluents.

A survey of the south-east coast of Arabia, begun by Capt. Haines in 1833, was discontinued in 1837 owing to the exigencies of the service; and from 1839 to 1844, in consequence of the war in Afghanistan and want of money for general purposes, marine surveys by the Indian Navy were almost entirely in abeyance. In 1839, however, perhaps in connection with the occupation of Kharag, a report on the harbour of Kuwait was made by an officer of the Indian Navy. The survey of the south-east coast of Arabia was resumed in 1844 and completed in 1848. In 1857, it having been decided to revise the

¹ Further, it must not be forgotten that surveying was but a small part of the work of the Indian Navy and that the operations were carried on only when other duties of watch and ward, such as the hunting down of pirates and the suppression of the slave trade, permitted.

Persian Gulf Survey of 1820-8, in which errors and omissions were known to exist, Captain C. Constable, assisted by Lieut. A. W. Stiffe, was appointed to carry out the work. He completed it in 1860, and the result of the labours of the two officers was a general chart of the Persian Gulf in two sheets, of which the essential features were reliable, but which Capt. Constable himself described in 1862 as not being on nearly large enough a scale. Meanwhile a survey of the harbour of Bahrain was made by Lieut. Whish, I.N., in 1859.

At the end of 1862, the vessels of the Indian Navy serving in the Persian Gulf were recalled to India. On April 30th, 1863, the Indian Navy ceased to exist. It was understood at the time of the change that the duties performed in the past by the ships of the Indian Navy would devolve in future on those of the Royal Navy; but some years elapsed before a practical method of working with the substituted force was devised and, in the interval British political interests suffered severely in the Persian Gulf, the Red Sea and elsewhere. For ten years and more no fresh surveys were undertaken, and many original drawings and memoirs, the fruit of expensive surveys, were lost. In 1871 the Government of Bombay, having awakened to the necessity for new surveys, consulted Col. Pelly, and a general discussion of the subject was initiated, the upshot of which was that Mr. Girdlestone, formerly a midshipman in the Indian Navy, was deputed to the Persian Gulf from 1871 to 1874 to make a survey of Bahrain and Qatar waters: the survey was extended towards the mainland, not without some opposition on the part of local Turkish authorities who were, however, over-ruled by the Wali of Baghdad. In 1876, the inlet of Khor-al-Hajar on the coast of Oman was surveyed. In 1886, the inlet of Khor Bani Bu Ali was discovered by a British naval vessel and, in 1888, the Bahmanshir was partially examined, in connection with the opening of the Karun River to navigation in the same year.

In 1890, the approaches of the Shatt-al-Arab and Bahmanshir from the sea were surveyed by British vessels; with the assent of the Persian Government the Bahmanshir was examined and sketched in the same year and its impracticability for ocean steamers demonstrated. By permission of the Shah and of the Sultan of Oman, British tidal observation stations were established at Bushire and Muscat in 1892 and 1893 and, in 1894, telegraphic observations were undertaken at the Bushire and Jask telegraph stations with a view to the determination of longitude.

In 1901, a fresh survey of the approaches to Bahrain and the Manamah harbour was made. These isolated surveys were, however, of little practical value, and it was not until Lord Curzon's viceroyalty that any active steps were taken to continue and extend the surveys of the old Indian Navy: thirty valuable years had been lost. Bushire harbour was re-surveyed in 1903, with the consent of the Persian Government, though they intimated that, whatever the result of the investigations, they would neither deepen the harbour themselves nor permit it to be deepened by the Government of India. As a matter of fact, the soundings showed that the deepening of the inner anchorage and the approach to it from seawards for ships of heavy draft would be of little use so long as the bar of the Shatt-al-Arab continued to regulate the size of vessels employed in the Persian Gulf, but that the dredging of a channel for vessels of moderate size from the inner anchorage to the wharves on Khor Sultani would be an advantageous and, probably, not a difficult operation. In 1904, Kuwait harbour was re-surveyed, the work not being completed until 1907, and not without violent protests from the Turkish Government. In 1904-5 H.M.S. *Redbreast* made a detailed examination of Khor-al-Qal'iyah of Bahrain Island, which, it was hoped, might afford superior harbour facilities to those of the exposed anchorage off Manamah: the results, however, were negative.

In 1905-6, the R.L.M.S. *Investigator* was again employed in the Gulf, and completed the surveys of the mouth of the Shatt-al-Arab, the approaches thereto, and the port of Kuwait. In 1906 the Marine Survey of India carried out surveys of the Khor Abdullah and of the Khor Zubair from its source.

From this date until 1910, no surveys were undertaken in the Gulf, but, at the latter end of this year, R.L.M.S. *Palinurus* was recalled from her survey work on the west coast of India, and despatched up the Gulf to re-survey the mouths of the Shatt-al-Arab. Again the Turkish authorities placed every obstacle in the way of this survey, refusing permission to land a party at Fao for observations of the rise and fall of the tides and, on several occasions, cut adrift the moored beacon buoys that were used.

Then, until the Great War, 1914, the *Palinurus* was employed continuously in the Gulf and completed the following surveys:—

1911-12. The approaches to the Shatt-al-Arab, as far as Kubbar Island.

1912-13. The approaches to Bahrain harbour; a plan of Bandar Abbas; and of Hanjam Sound.

1914. Clarence Straits.

During the Great War, several surveys of various parts of the Shatt-al-Arab were completed by the survey officers of the Royal Indian Marine.

In 1921-22 the R.I.M.S. *Palinurus* was again employed in the Persian Gulf, but mostly in small investigations: no definite surveys were completed.

GEOLOGY

The paucity of the bibliography appended to Dr. Pilgrim's Memoir of 1905 (quoted below) is a measure of the interest taken in the application to the Persian Gulf of this branch of science until the beginning of the present century.

From 1855, when Loftus¹ first published his valuable paper, little, if anything, of value on this subject was published, except by De Morgan, till 1904, when Lord Curzon sent Dr. G. E. Pilgrim of the Indian Geological Department to the Gulf. He made a general geological reconnaissance of both coasts, combined with a closer examination of localities, where the existence of minerals was suspected; some coal seams in the country behind Sur in Oman had previously been scientifically examined by Doctors von Krafft and Oldham of the same department.

Since the appearance of Dr. Pilgrim's report, no further geological research in this region has been undertaken by the Government of India or by His Majesty's Government. Between 1901 and the present day, however, an immense amount of work has been done by the geologists of the Anglo-Persian Oil Company, Limited, some of the results of which are embodied in Mr. Richardson's paper of 1924. A careful enquiry, with negative results, was also made in 1920 by an expert on behalf of the Persian Mining Syndicate, Limited, regarding the copper-mines of Kerman. But the geology of the Arabian side of the Persian Gulf and the Gulf of Oman is little, if at all, better known than fifty years ago, and the hinterland is still virtually a sealed book.

Geological Bibliography:² (Only such items as are not referred to in Dr. Pilgrim's Bibliography are given.)

Notes made (in 1822) in the course of a voyage from Bombay to Bushire.

J. B. Fraser, *Trans. Geol. Soc.*, second series, vol. i, 1824.

Halurgische. Geologie. Alberti. 1845.

On the geological evidence of the advance of the land at the head of the Persian Gulf. C. T. Beke. *Lon. and Ed. Philos. Mag.*, vol. 7, pp. 40-46, 1835.

On the Alluvia of Babylonia and Chaldea. C. T. Beke. *Lon. and Ed. Philos. Mag.*, vol. 14, pp. 426-32, 1839.

Note on the Pliocene Deposits of the Shores of the Arabian Sea. H. J. Carter. *Journal, Bombay Branch Royal Asiatic Soc.*, series iv, 1852.

La structure du sol (with geological sections from Bushire to Deh-Bid and Dilam to Malamir.) Frederic Houssay. *Annales de Géographie*, 1894.

Geology of the Persian Gulf. Dr. G. E. Pilgrim, *Memoirs Geol. Survey of India*, vol. 34, Part 4 (1908). 1905.

Salt Deposits in Persia and their relation to the sea. (Abstract of report to Imperial Academy of Sciences, Vienna.) Dr. K. Natterer, *G.J.*, vi., p. 472, 1895.

Earthquake at Gwadar. H. J. Walton. *Trans, Bombay Geog. Soc.*, xvii, Oct., 1864.

Mineralvorkommen der Insel Ormuz. F. Cornu. *Tschermak Min. petr. Mitth.*, vol. 26, pp. 341-42, 1907.

¹ W. K. Loftus, appointed to succeed Mr. Angus as Naturalist and Geologist, left England to join the Turco-Persian Frontier Commission under Lt.-Col. Williams in January, 1849, on a salary of £200 a year. (Return to House of Commons, April 10, 1851.)

²With acknowledgments to Mr. N. Campbell Smith, m.c., Brit. Mus. Nat. Hist.

- Geology in Central and North-West Persia. A. F. Stahl, *Petermann's Mitteilungen*, 1907.
- Persien. *Handbuck der regionalen Geologie*. A. F. Stahl, 1911.
- Die Turkische-Persischen Erdsivarkommen*. Dr. Walter Schweer. Hamburg, 1919.
- Notes on Geology, Ethnology and Climate of the Persian Gulf. Dr. Gerhard Schott. *Mitteilungen der Geographischen Gesellschaft*, Hamburg, 1918.
- Some Notes on the Geology of the Persian Oil Fields. H. G. Busk and H. T. Mayo, *Jour. Inst. Petrol, Technol.*, 1918.
- Geology of the Persian Oil Fields. Anon. *Nature*, vol. 102, pp. 234-5, 1918.
- Oil Fields of Persia. C. M. Hunter. *Bulletin 158, American Institute of Mining, etc.*, 1920.
- Petroleum in Persia and the Near East. E. M. Spieker, *Eng. and Mining Journal*, 1920.
- The Heart of Arabia*, 2 vols. (Appendix). H. St. J. Philby, 1922.
- Fishes the Source of Petroleum*. J. M. Macfarlane, 1923.
- The World Oil Situation. A. C. Bedford. *American Quarterly Review of Foreign Affairs*, 1923.
- The Geology and Oil Measures of South-West Persia. R. K. Richardson. *Jour. Inst. Petrol, Tech.*, vol. 10, No. 43.
- Cambridge Ancient History*, vol. i. Egypt and Babylonia, 1924.
- The Delta of the Shatt-al-Arab and Proposals for dredging the Bar. A. T. Wilson. *G. J.*, Feb. 1925.
- In Unknown Arabia*, Maj. R. E. Cheesman, O.B.E., 1926.

MEDICAL .

There is a very notable lack of published information on medical subjects relating to this region. The only recent technical articles on the subject are by Dr. Sir W. Willcox, K.C.I.E., C.B., C.M.G., in the 12th edition of the *Encyclopædia Britannica* under the heading "Persian Gulf," and three most valuable articles by Dr. Neligan, Physician to the British Legation at Tehran, in the *Lancet* for March 20, March 27, and April 3, 1926; who has also written a compendium under the title *Hints for Residents and Travellers in Persia* (1914). Epidemics and Sanitary Organisation in this region have, however, received a great deal of attention. The general history of plague and cholera is given in the appropriate articles of the *Encyclopædia Britannica*; notices of early epidemics of plague will be found in an official précis *The First Connection of the Hon. E. I. Coy, with Turkish Arabia*, Calcutta, 1874; and an article, "Notes on Cholera in Persia," by Surgeon-Major T. Ffrench Mullen in the Persian Gulf Administration Report for 1889-90 has a wider scope than its name suggests, and gives a general account of the movements of cholera, especially in Western Asia, since 1821. The outbreak of cholera in Oman, in 1899, is discussed in Lt.-Col. A. S. G. Jayakar's "Report on the Recent Epidemic of Cholera in Maskat and Matrah"—in the Persian Gulf Administration Report for 1899-1900.

The general practice of medicine by European doctors in Persia is discussed by Mrs. Bishop in *Journeys in Persia and Kurdistan*, 1891; by E. Treacher Collins in *In the Kingdom of the Shah*, 1896; and by Dr. C. J. Wills in *In the Land of the Lion and the Sun*, 1883; and numerous further references thereto are to be found in current literature, particularly in Mrs. C. Colliver Rice's *Persian Women and their Ways*, 1923. See also: *A Chapter from the History of Cannabis Indica*, by E. G. Browne in *St. Bart's Hosp. Jour.*, 1897, March and "The Opium Trade through Persian Spectacles," by A. T. Wilson, *As. Rev.*, 1925, April, vol. xxi.

The subject of medical missions is treated by the Rev. S. M. Zwemer in *Arabia: The Cradle of Islam*, and by P. W. Harrison in *The Arab at Home*, 1924.

METEOROLOGY

The literature on this subject is very extensive: early travellers of every nationality vied with each other in picturesque denunciations of the climate of the Persian Gulf, and more particularly of Muscat, Bandar Abbas, Hormuz and Bushire, Arab and Persian writers being no whit less intemperate than Europeans in their allusions to the subject. Prevailing winds were carefully studied and accurately described, and the potentialities of various ports as sources of fresh water were better known in the sixteenth and seventeenth

centuries than they are to-day. Generations of British Consular and Telegraph Officials have derived a dismal satisfaction from their self-imposed task of taking daily thermometer readings and submitting periodical reports on the subject to a "higher authority" more fortunately situated in Whitehall or on a Himalayan hill-top, and these melancholy statistics have been regularly tabulated and embodied in annual reports, books of travel and the like, and occur with monotonous regularity in the form of appendices to every official report dealing with the area. But these dry bones tell us little: the wet-bulb temperature alone affords any real indication of the probable degree of discomfort that will be experienced by a European at any particular place and time, and such records have not, as a rule, been kept so carefully nor, where available, are they so reliable, as the dry-bulb figures.

Apart from local statistical information, the chief recent sources of information are as follows:—

- (1) The Persian Gulf Pilof.
- (2) The Annual Summaries of the Meteorological Department of the Government of India.
- (3) An article, "Climatology of Southern and Western Asia," by W. L. Dallas, of the Meteorological Department of the Government of India, in the proceedings of the Chicago Congress of August, 1893, Meteorological Section, pp. 672-686. A lecture on "Weather and Warfare" delivered by the same authority before the United Service Instit. of India (*vide* Journal for Oct., 1904).
- (4) "The Weather of Iraq"—a comprehensive non-technical memorandum by Mr. Norman of the same Department, whilst on active service in Mesopotamia.
- (5) "Notes on Climate and other subjects in Eastern Mediterranean and adjacent countries. I. D. 1117. Prepared on behalf of the Admiralty and War Office." (Including statistics of Mesopotamia and the Persian Gulf.)

Mention must also be made of two valuable papers published in German by Dr. Gerhard Schott:

- (1) On the salinity of the Persian Gulf and its adjoining waters. *Annalen der Hydrographie*, 1908.
- (2) The geography of the Persian Gulf and its neighbourhood. *Mitteilungen der Geographische, Gesellschaft*, Hamburg, 1918.

It is sad to reflect that, with all this wealth of information at their disposal, in addition to a vast mass of official literature on the subject, accumulated by military and civil officials during the last hundred years, the military authorities in India, on the outbreak of the World War, declared themselves (no doubt with perfect truth) to be entirely ignorant of the climatic conditions at the head of the Gulf, and proceeded to display an ineptitude in the provision of clothing, medical and hospital equipment, and food which, though it brought disgrace and dismissal to no individual, involved tens of thousands in untold miseries, brought death to thousands, and did more than is even yet realized to damage the good name of the Government of India at home and abroad. British officials are in no way inferior to Germans in the systematic collection and transmission of information; our national weakness lies, in the writer's judgment, in the reluctance shown at headquarters—whether in Whitehall, or Simla, or elsewhere—to retain the small additional staff necessary to collate and compile the information that reaches the central administrations, and to the general tendency to trust to hasty improvisations and to ignore or belittle the value of expert testimony and scientific investigation.

Music

Floyer, in his *Unexplored Baluchistan*, 1882, Appendix E, and Rivadeneyra, in his *Viaje al interior de Persia*, Madrid, 1880, vol. ii, p. 265, make some brief references to Baluch and Lur harmonies respectively, and give some musical scores; there are also several reproductions in European notation of Persian harmonies in *Popular Poetry of Persia*, translated by Alexander Chodzko, 1842. References to Persian music and musical instruments, of much interest, are also to be found in many works, notably those of Chardin, Le Brun, Niebuhr, Ouseley, Jourdain and Waring. Probably the only detailed work on the subject of European music in the Persian language is the *Dastur-ul-Tar*, a treatise on the banjo and guitar, by Col. Ali Naqi Khan Waziri.

PHILOLOGY

The dialects of Arabic and Persian spoken on the Persian Gulf littoral differ considerably from the parent tongues, as spoken to-day on the plateaux of Arabia and Persia respectively. Each dialect, as is to be expected, owes much to the other: both have incorporated certain words of foreign origin which reflect the history of the Gulf and its use as a highway from earliest times; but excluding these words, none of which, except a few words borrowed from the language of the western littoral of India, are peculiar to the Gulf, there remains, it appears, a residuum of words, mainly relating to ships, and to the practice of navigation, which are neither Arabic nor Avestic in origin and which are common to both sides of the Gulf. It is not beyond the bounds of possibility that these words may prove to be of "Sumerian" origin: in any case, expert inquiry into this department of science might be of assistance to archæologists and anthropologists alike. In 1889, Surgeon-Major A. S. G. Jayakar published some notes on the Omani dialect of Arabic, in the Journal of the Royal Asiatic Society. Lt.-Col. D. L. R. Lorimer gave us in 1922 (Royal Asiatic Society's Prize Publication) a scholarly survey of the Kermani dialect and Bakhtiari dialects: Major Phillott has published an amusing series of proverbs current at Kirman; and Lt.-Col. and Mrs. Lorimer have laid the children of England under an abiding obligation by the publication, in 1919, of a charming volume of *Persian Tales*, still current among the common people in South Persia. The works of the late Prof. E. G. Browne are not less indispensable to those who live in South Persia than to those who live in the North. The Rev. J. Van Ess wrote, for the use of the Army in Mesopotamia during the war, a careful summary of the *Spoken Arabic of Mesopotamia*, supplemented two years later by a more ambitious, but not less useful work on *Written Arabic*. Finally, reference must be made to the monograph on the Baluch language, spoken along the Makran Coast, which is included in vol. x of the Linguistic Survey of India by Sir G. A. Grierson.

TERRESTRIAL MAGNETISM

In this field of research, it has fallen to the United States to lead the way. One of the main objects, to which the energies of the Department of Research in Terrestrial Magnetism, of the Carnegie Institution of Washington, have been devoted since 1904, has been a general magnetic survey of the globe. This survey has now been completed for the major part of the earth, and the results are being published in a series of voluminous reports under the title "Land" and "Ocean Magnetic Observations," covering the period from 1905 to 1921. Four volumes had (1924) already been issued and a fifth and final volume to be entitled "Ocean and Magnetic Observations, 1915-1921, and Special Reports," is in course of preparation. With the completion of vol. v it will be possible to undertake the reduction of the accumulated magnetic data since 1905, to a common datum for the construction of new world magnetic charts, and to make a new analysis of the earth's magnetic field on a basis of more complete and more accurate data than heretofore available.

The researches of the Department were confined, in the main, to the oceans and to those countries or regions where magnetic data would not otherwise be obtainable; and in some regions the magnetic surveys were accomplished in co-operation with existing organisations or with interested investigators. In Asia, the observers who were assigned to this continent obtained magnetic data in every state, excepting Afghanistan, the Himalaya States, and Chosen. The Persian Gulf region itself—including the territories of Persia, Iraq and Arabia—which formed but a small section of the field of operations in Asia—was fortunate in falling under the detailed scrutiny of the observers. Observation stations were established, between the years 1905 and 1910, at a great number of places, well distributed over the whole area. On the Persian side of the Gulf, observations were made at Tehran, Hamadan, Kermanshah, Shustar, Ahwaz, Mohammerah, Shiraz, Bushire, Lingeh, Jask, besides some thirty or more other places; in the Euphrates-Tigris area, at Mosul, Baghdad, and Basra among other places; and in Arabia at Kuwait, Bahrain Island, Aden and Ma'an. Volume i of the report includes a valuable description of

each of the stations, and the conditions under which the magnetic observations were made, indicating, in most cases, the precise spot at which operations took place, thus making matters comparatively easy for further investigations at these places. Volume iv gives detailed information of much value regarding the methods used by the observers. The volumes issued are under the following titles¹ :—

- Researches of the Department of Terrestrial Magnetism, of the Carnegie Institution of Washington :—
- Vol. i. Land Magnetic Observations, 1905-1910.
 - Vol. ii. Land Magnetic Observations, 1911-1913, and Report on Special Researches.
 - Vol. iii. Ocean Magnetic Observations, 1905-1916, and Report on Special Researches.
 - Vol. iv. Land Magnetic Observations, 1914-1920.
 - Vol. v. Ocean Magnetic Observations, 1915-1921 and Special Reports.

ZOOLOGY

(a) *Mammals, Birds, Reptiles, Insects.*—

Ainsworth, who accompanied the Chesney Expedition,² already referred to, furnished Col. Chesney with reports on the natural history of the region traversed, including mammals, birds, reptiles, and fishes, which were in due course published.

Mr. W. T. Blanford, who accompanied Sir F. Goldsmid's Mission in South-East Persia, contributed to the latter's memoirs, in 1876, a supplementary volume in which his own extensive researches into the fauna of South-East Persia were collated with all material then available regarding the fauna of Persia generally. In 1905, and again in 1911, two British naturalists, the late Col. Bailward and Mr. Woosnam, travelled in Arabistan and made extensive collections of birds and small mammals. Sir P. Z. Cox, in the course of a long and distinguished career in the Persian Gulf, extending over nearly thirty years, found time to devote some attention to zoology which, after philately, was his favourite hobby: the pages of the *Bombay Natural History Society's Journal*, and the collections in the South Kensington Museum, bear witness to the keen scientific interest he took in the subject. It was largely owing to his foresight that the Bombay Natural History Society published,³ after the war, a collection of monographs of exceptional value on the fauna of Iraq, its butterflies, moths, beetles, and innumerable insect pests. These memoirs, whilst dealing primarily with Iraq, apply in large measure to the Persian Gulf region, which is inhabited or visited largely by the same species as Iraq. To his initiative, the London Zoological Gardens owe a fine specimen of *Oryx*,⁴ presented to H.M. The King, by Ibn Saud, and a pair of ostriches from Central Arabia, the first specimens of this rare struthious bird to reach Europe alive.

¹ All volumes quoted are to be seen at the following libraries in London :—

British Library of Political Science.
Library of the Royal Society.
Library of the Science Museum.
University College Library.
University of London Library.
Institute of Petroleum Technologists.

² Chesney, *Expedition to the Euphrates and Tigris*, vol. ii. Appendices, ii-vi, 1850.

³ *A Survey of the Fauna of Iraq*, Dulau & Co., 1922.

⁴ It is generally supposed that unicorns, which Varthema saw at Mecca in 1503 and which he described in great detail, were anomalous specimens of the *Oryx*: on the other hand, the figure of the unicorn, as depicted in several places at Persepolis, is referred to by Pliny (*Hist. Nat.* viii, 21) and in the Bible; whilst in more recent times, Don Juan Gabriel, a Portuguese colonel, who lived several years in Abyssinia, claimed that he had actually seen it, and his account was confirmed by a Portuguese missionary who was then living in Abyssinia; it is also reported from the Cape of Good Hope in 1792 (see Varthema's *Travels*, Hakluyt Soc., 1863, and Renaudot's *Ancient Accounts of India and China*, 1733, pp. xxv, 17 and 61).

To him also we are indebted for the recent important accessions to our knowledge of the birds and mammals of the Persian Gulf and Central Arabia, collected on his behalf during 1922-24, by his Secretary, Capt. R. E. Cheesman, now H. M.'s Consul at Addis Ababa. As a result of these researches, our knowledge of the zoology of the Gulf region is more complete and accurate than in any other branch of science.

The upshot of these investigations is to show that South Persia and the Persian Gulf region are inhabited by animals which show, in every group, far closer affinity to European than to Indian forms: the Perso-Baluch frontier or the Sind desert east of it thus constitutes a line of demarcation which is both ethnological and zoological.

Additional Bibliography:¹

Mammals.—

Nature at the Desert's Edge, by Major R. W. G. Hingston, 1925.

A new race of Hare from the Persian Frontier of Mesopotamia. *Records of Ind. Mus.*, vol. xv, p. 49.

On some Specimens of Mammals from Oman, South-East Arabia, by O. Thomas. Collected by Dr. Jayakar. *P. Z. S.*, 1894, p. 448.

Five new Mammals from Arabia and Persia,² by O. Thomas, *Annals and Mag. Nat. Hist.*, Ser. 7, vol. x, Dec. 1902.

On a collection of Mammals from Persia and Armenia presented to the Brit. Museum, by Col. A. C. Bailward. O. Thomas, *P. Z. S.*, 1905, vol. ii, No. xxxv, p. 519.

On Mammals from Northern Persia, presented to the National Museum, by Col. A. C. Bailward. O. Thomas, *Ann. and Mag. of Nat. Hist.*, Ser. 7, vol. xx, Sept. 1907.

Birds.—

A list of papers on birds in this region follows Ticehurst's Birds of Mesopotamia, in *Survey of Iraq Fauna*. The following are additional papers:—

Notes on the Bird Life of Ahwaz, Persia. F. Ludlow. *J.B.N.H.S.*, vol. xxv, p. 303.

On a collection of Birds from the vicinity of Muscat. (Made by Col. Miles). R. B. Sharpe. *Ibid.*, 1886, p. 162.

J. S. Whittaker on two species of Passerine Birds (Cummig's Chat). *Ibid.*, 1902, p. 58.

Un viaggio in Persia, nel 1862. F. de Filippi, Milano.

Astola. "A summer cruise in the Gulf of Oman." Butler, *Stray Feathers*, 1877, p. 283.

Birds of Jabrin, Jafura and Hasa, and of Bahrain Islands, Persian Gulf. Ticehurst and Cheesman. *J. B. N. H. S.*, Jan., 1925.

Birds of the Persian Gulf Islands. Ticehurst and Cox, *J. B. N. H. S.*, vol. xxx, p. 725.

Birds of Iraq. Ticehurst and Cox, supplementary papers. *J. B. N. H. S.*, vol. xxxi, p. 91.

Reptiles.—

Description of a new sand boa from the Persian Gulf (Kuwait). *Records of the Indian Museum*, ix, p. 217.

Insects.—

Description of two new species of Diptera from Seistan, East Persia. *Records of the Indian Museum*, xvi, p. 299.

(b) Fish and Fisheries.—

The best recent general authority on this subject is S. B. Miles, in *The Countries and Tribes of the Persian Gulf*, 2 vols., 1919. Other sources of information are articles in the *Bombay Natural History Society's Journal* as follows:—

Vol. xiv, 1901. On Some Deep Sea Fishes collected by Mr. F. W. Townsend in the Sea of Oman. G. A. Boulenger. (In the same volume is an interesting note regarding Sword Fishes striking a ship (Muscat).)

¹ With acknowledgements to Capt. R. E. Cheesman.

² This includes the Arabian fox and Witherby's field mouse.

Vol. xxiv (4) and xxv (1); 1916-7. The Game Fishes of the Persian Gulf. Major W. H. Lane.

For detailed zoological information regarding marine fishes, consult *A Bibliography of Fishes*, by Bashford Dean, published by the American Museum of Natural History; and, in particular, works by Annandale, Boulenger, Day (The Fishes of Zanzibar, 1866 with illustrations) and Regan.

The war gave birth to a crop of fisherman's stories of great carp in Mesopotamia, which saw the light in the *Bombay Nat. Hist. Soc. Jour.*, vols. xxv, xxvi, xxvii (1918-20).

For details of sea-snakes in the Persian Gulf, see *Bombay Nat. Hist. Soc. Jour.*, vol. xxx, 1924, p. 174.

On the general question of Persian Gulf fisheries, the most authoritative source is still Dr. McIvor's report published in the Persian Gulf Political Residency Administration Report for 1880-1, entitled "Notes on Sea Fishing in the Persian Gulf."

Further information regarding the fresh water fish of Iraq is contained in Cuinet's *La Turquie d'Asie*, 1894, vol. ii.

Other papers are:—

An enemy of certain Pearl Oysters in the Persian Gulf. Annandale.

Records of the Indian Museum, vol. i, p. 176. (This gives the names of three varieties of Persian Gulf Pearl Oyster).

Notes on Fish from India and Persia, with descriptions of new species. J. T. Jenkins.

On a collection of Fishes made by W. T. Blanford in 1872, in Persia and Baluchistan. *Records of the Indian Museum*, vol. v, p. 123.

Report on the Aquatic Fauna of the Seistan with subsidiary studies. (Fish—mollusca—birds, etc.) *Records of the Indian Museum*, vol. xviii.

Remarks on the Oyster Beds in the Persian Gulf. Lewis Pelly. *Trans. Bomb. Br. Roy. As. Soc.* 1868, xviii.

An account of the fishes obtained by Surgeon Major A. S. G. Jayakar at Muscat, east coast of Arabia, G. A. Boulenger. *Proc. Zool. Soc.*, 1887, pp. 653-67.

Second account of the fishes obtained by Surgeon Major A. S. G. Jayakar at Muscat, east coast of Arabia. G. A. Boulenger. *Proc. Zool. Soc.*, 1889, pt. 2, pp. 236-46.

Third account of the fishes obtained by Surgeon Major A. S. G. Jayakar at Muscat, east coast of Arabia. G. A. Boulenger. *Proc. Zool. Soc.*, 1892, pp. 134-36.

Six semaines de dragages sur les bancs perliers du Golfe Persique. Ch. C. Pérez. *Bull. professionnel et technique des pêches maritimes*.

Perlen und Fischhandel des Persischen Golfes. R. Brenner. *Peterm. Mitteil.*, 1873, pp. 60-62.

Perlfischerei im Persische Meerbusen. Anon. *Vossische Zeitung*, 1881, no. 37.

(c) *Mollusca*.—

Of the numerous monographs, referred to below, on the Mollusca of the Persian Gulf, the greater number were based on specimens obtained by Mr. F. W. Townsend, who for many years commanded the Indo-European Telegraph Department's cable ship "Patrick Stewart." The complete list¹ is as follows:—

New Species from the Persian Gulf. E. A. Smith. *Ann. and Mag. Nat. Hist.*, May 1872, pp. 351-355.

Description of 34 species of Marine Mollusca from the Arabian Sea, Persian Gulf and Gulf of Oman. J. C. Melvill. *Mem. and Proc., Manchester, Lit. and Phil. Soc.*, vol. 41, pt. 3, pp. 1-25 and 2 plates.

Further Investigations into the Mollusca Fauna of the Arabian Sea, Persian Gulf and Gulf of Oman with descriptions of 40 species. *Op. cit.*, vol. 42, pt. 2, pp. 1-40, and 2 plates.

¹ For this the writer is indebted to Mr. J. R. le B. Tomlin, M.A., of the British Museum (Natural History Section).

- Notes on the Mollusca of the Arabian Sea, Persian Gulf and Gulf of Oman, mostly dredged by Mr. F. W. Townsend, with descriptions of 27 species. *Ann. and Mag. N. H.* (7) iv, pp. 81-101, with 2 plates.
- Description of Conns (Cylinder) *Clytospira* 2 p.n. from the Arabian Sea. *Ann. and Mag. N. H.* (7) iv. 461-3.
- The Mollusca of the Persian Gulf, Gulf of Oman and Arabian Sea as evidenced mainly through the collections of Mr. F. W. Townsend, 1893-1900, with description of new species. By J. C. Melvill and R. Standen. *Pr. Zool. Soc.*, 1901, pp. 327-460, with 4 plates.
- The genus *Scala* as represented in the Persian Gulf, Gulf of Oman and North Arabian Sea with description of new species. By Melvill and Standen. *Journ. of Conch.*, vol. x, pp. 340-51, and one plate.
- A Revision of the Columbellidae of the Persian Gulf and North Arabian Sea with description of *C. calliope* n. 2 p. Melvill. *Journ. of Malacology*, x, 27-31.
- Descriptions of 68 new Gastropoda from the Persian Gulf, Gulf of Oman and North Arabian Sea, dredged by Mr. F. W. Townsend of the Indo-European Telegr. Service, 1901-3. *Ann. and Mag. N. H.* (7) xii, 299-324, with 4 plates.
- Descriptions of 23 species of Gastropoda from the Persian Gulf, Gulf of Oman and Arabian Sea, dredged by Mr. F. W. Townsend of the Indo-European Telegr. Service, 1903. By Melvill. *Proc. Malac. Soc.*, vi, 51-60, with plate.
- On *Berthais*, a proposed new Genus of Marine Gastropoda from the Gulf of Oman. By Melvill. *Proc. Malac. Soc.*, vi, pp. 61-3.
- Descriptions of 28 species of Gastropoda from the Persian Gulf, Gulf of Oman and Arabian Sea, dredged by Mr. F. W. Townsend of the Indo-European Telegr. Service, 1900-4. By Melvill. *Proc. Malac. Soc.*, vi, 158-69, with plate.
- Conus coromandelicus*, *Smith*, its probable affinities and systematic position in the Family Conidae. By Melvill. *Proc. Malac. Soc.*, vi, 170-73.
- Descriptions of 12 new species and one of Marine Gastropoda from the Persian Gulf, Gulf of Oman and Arabian Sea collected by Mr. F. W. Townsend, 1902-4. *Journ. of Malac.*, xi, 79-84, with plate.
- Note on *Mitra Stephanucha*, *Mch.*, with description of a proposed new variety. By Melvill. *Journ. Malac.* xi, 86.
- Rostellaria delicatula*, *Nevill*, notes on its distribution and limits of Variation. By Melvill and Standen. *Journ. of Conch.*, vol. xi, 161-3, with plate.
- Descriptions of 31 Gastropoda and one Senphopod from the Persian Gulf and Gulf of Oman, dredged by Mr. F. W. Townsend, 1902-4. Melvill. *Proc. Malac. Soc.*, vii, pp. 69-80, with 2 plates.
- Capulus lissus*, *Smith* as type of a proposed new sub-genus. By Melvill. *Proc. Malac. Soc.*, vii, 81-4.
- The Mollusca of the Persian Gulf, Gulf of Oman and Arabian Sea as evidenced mainly through the collections of Mr. F. W. Townsend, 1893-1906, with descriptions of new species. Melvill and Standen. *Proc. Zool. Soc.*, 1907, 783-848, with 4 plates.
- Descriptions of 29 species of Marine Mollusca from the Persian Gulf, Gulf of Oman and North Arabian Sea, mostly collected by Mr. F. W. Townsend, of the Indo-European Telegr. Service. Melvill. *Ann. and Mag. Nat. Hist.* (8), vi, pp. 1-17 and 2 plates.
- A Revision of the Species of Pyramidellidae occurring in the Persian Gulf, Gulf of Oman and North Arabian Sea, with description of new species. Melvill. *Proc. Malac. Soc.*, ix, 171-207, with 3 plates.
- Descriptions of 33 new species of Gastropoda from the Persian Gulf, Gulf of Oman, and North Arabian Sea. Melvill. *Proc. Malac. Soc.*, x., 240-54, with 2 plates.
- Revision of the Species of *Terebra* occurring in the Persian Gulf, Gulf of Oman and Arabian Sea as evidenced in the Collection formed by Mr. F. W. Townsend, 1893-1914. Melvill and Standen. *Journ. of Conch.*, xv, 204-16.
- Revision of the Turridae occurring in the Persian Gulf, Gulf of Oman and North Arabian Sea, as evidenced mostly through the results of dredgings carried out by Mr. F. W. Townsend, 1893-1914. By Melvill. *Proc. Malac. Soc.*, xii, 140-201, with 3 plates.

Descriptions of 34 species of Marine Mollusca from the Persian Gulf, Gulf of Oman and Arabian Sea, collected by Mr. F. W. Townsend. *Ann. and Mag. N. H.* (9), i, pp. 137-58, with 2 plates.

Freshwater shells from Mesopotamia. *Records of the Indian Museum.* vol. xv, p. 159.

Mention should also be made of an article by J. C. Melvill and R. Standen on the Mollusca of the Persian Gulf, Gulf of Oman and Arabian Sea in the *Proceedings of the Zoological Society* for 1901, vol. ii, and a further article on the same subject by Melvill, in vol. xlii of the *Transactions of the Manchester Literary and Philosophical Society*, 1897.

General.—

In Unknown Arabia, Maj. R. E. Cheesman, O.B.E., 1926.